Middle Eastern Carbonate Tunnels May Sequester Greenhouse Gases

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It has long been understood that carbonate soils and rocks (limestone, dolomite, limestone sandstone, caliche) caves, cavities, karsts, sinkholes, boreholes, wells, mines, subways, and tunnels, and even salt beds, may indefinitely sequester greenhouse gases, based on applied research by the United States Geological Survey (2013) and several major universities (Trendafilova, 2022).

Major programs are established by the University of Aberdeen; Imperial College London; Massachusetts Institute of Technology Carbon Capture and Storage Center; Arizona State University Carbon Center for Negative Carbon Emissions; Stanford University Center for Carbon Storage; University of Cambridge Carbon Capture, Storage and Use Research; University of Michigan Global CO_2 Initiative; Sheffield University Research into Carbon Dioxide Utilization; University of Wyoming Center for Carbon Capture and Conversion; and Texas University Carbon Management Program.

Recent events have publicized that there are extensive anthropogenic (human-caused) military tunnels in and around the Lebanon-Israel and Gaza-Israel borders. These tunnels are within limestone, limestone sandstone, and other bedrock (Reuters, 2024; Wikipedia, 2024). Journalists revise the number and their extent every few weeks, but it certainly includes well over hundreds of miles.

Based on my 1964 field work in the Bronx's Jerome River Valley, the term "sandstone," loosely cemented sand grains, applied to "limestone," grains of calcite, as "limestone sandstone" means *limestone of sandy grains*, usually was used by construction workers.

According to the United States Geological Survey (USGS, no date) "carbon dioxide is the most produced greenhouse gas (GHG). Carbon sequestering is the process of capturing and storing atmospheric carbon dioxide. It is the method of reducing the amount of carbon dioxide (CO_2) in the atmosphere with the goal of reducing global climate change. The USGS is conducting assessments on two major types of carbon sequestering: geologic and biologic." An additional research area for sequestering atmospheric carbon is acidization of large surface-water bodies such as the Great Lakes, Caspian Sea, Lake Victoria, and the oceans by introducing excessive nutrients leading to algal growth (USEPA, 2024), or addition of iron particles as iron fertilization (Hance, 2023).

In geologic sequestering, CO_2 is pressurized or compressed into a liquid and injected into the subsurface to enhance oil recovery (Aramco, no date) or to store in underground formations. The potential carbon sequestering of atmospheric carbon in Gazan and Lebanese extensive rock tunnels (Figures 1 and 2) is daunting if peace would allow it.

Figure 1. Carbonate tunnel in Gaza (Fernholz, 2014)

Figure 2. Carbonate tunnel from Beirut to Southern Lebanon (Times of Israel, 2021)

For example, Gaza has 1,300 tunnels spanning 300 miles (Gigi, 2023) to 310 miles (Wikipedia, 2024, from Iranian Military Officer and Commander, Hassan Hassanzadeh, Islamic Revolutionary Guard Corps, April 2024). Hezbollah, with North Korean assistance, built 15 miles of tunnels, bunkers, fiber-optic communication systems, and storage rooms into Isreal (Wikipedia, August 13, 2024, from Kagen et al, 2008, Iranian influence in the Levant, Iraq, and Afghanistan). Beeri (2021) concluded that Hezbollah tunnels include hundreds of miles of tunnels in Southern Lebanon. It is likely these figures are low.

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